New Uranium Treatment Plant at Gerlach

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Gerlach General Improvement District (Gerlach GID) is one of the first in the state of Nevada to build a uranium treatment facility, the only other one being in the Washoe Valley at the Lightning W Ranch system. The treatment technology Gerlach decided to go with is a dual pressure vessel ion exchange treatment plant (which is what the Lightning W is also using). The two filter vessels are plumbed in series. Both filter vessels contain a strong anionic resin. This resin attracts and holds the uranium ions as the water passes through it.

This system works as follows: Water is collected from springs and piped to the original water storage tank, now called the raw water tank. When needed, water is pumped from the raw water tank through the water treatment plant at a rate of two hundred gallons per minute. The product water is then stored in a new 0.30 MG water storage tank, from which it gravity flows through the Gerlach distribution system.

Media is kept at optimum performance by two processes, backwashing and regeneration. Filter backwashing is done for the purpose of removing fine particulates which may become captured in the resin beds. This is not the same as media regeneration, which removes the uranium from the resin.

When a filter is backwashed, the backwash water is returned to the raw water or first water tank for retreatment. The raw water storage tank is emptied and cleaned once a year. Media regeneration consists of rinsing with a strong salt solution to displace the accumulated ions (uranium and competing ions). In softening treatment, this is usually done on-site. Because of the hazardous nature of uranium, the media will be removed and shipped out of state to a qualified facility for regeneration and proper disposal of the uranium at a radioactive waste storage facility. New media will then be installed.

The water from the springs passes through the first vessel where most of the uranium is removed. The second vessel acts as a polishing step to bring the uranium concentration down to well below the MCL. When the media in the first vessel is saturated with uranium it is removed and replaced with new media. The original "polishing" or second vessel now becomes the primary vessel and the vessel with the new media becomes the secondary or polishing vessel.

Under ideal conditions, this media type is predicted to last up to three years. However, because all source water chemistry and physical characteristics are rarely ideal, base lines are currently being established for the performance of this water treatment facility. Samples are being taken weekly for uranium content. Records are also being kept on the backwash frequency. The design engineer is predicting a one to two year effective capacity for each resin bed.

This plant has been on line, treating water for the Gerlach water system since the second of August and is performing well. If you are interested in visiting the Gerlach treatment facility a tour of the plant may be arranged through Jon Farnsworth, the water system operator. David T. Hunt of ECO:LOGIC was the consulting engineer and Petersen Construction, Incorporated was the contractor who did the actual construction of the plant. Funding of the facility was through a combination of an 80.4 percent grant from AB198 and 19.6 percent matching funds from CDBG and the Gerlach GID.

Here are some more facts about uranium:

Uranium is a naturally-occurring element found at low levels in virtually all rock, soil and water. It is both a toxic metal and radioactive. Concentrations vary depending on the type of minerals in the soil or bedrock. For example, in granite bedrock, such as is found in the Gerlach and Lake Tahoe areas, the average concentrations can be higher.

Uranium dissolves as water passes through soil and bedrock. Groundwater is likely to contain higher levels of uranium than surface water. The amount of uranium in well water varies with the concentration of uranium in the bedrock. Wells most likely to have high levels of uranium are those in areas with granite, alkaline sandstone or shale bedrock.

What are the health effects of Uranium?

The greatest health risk from large intakes of uranium is toxic damage to the kidneys because, in addition to being weakly radioactive, uranium is a toxic metal. Uranium exposure also increases the risk of getting cancer due to its radioactivity. Since uranium tends to concentrate in specific locations in the body, risk of bone cancer, liver cancer, and blood diseases (such as leukemia) are increased. In 2000, the EPA established the maximum contaminant level (MCL) of uranium to 30 parts per billion (30 micrograms per liter).

What is the treatment for Uranium in drinking water?

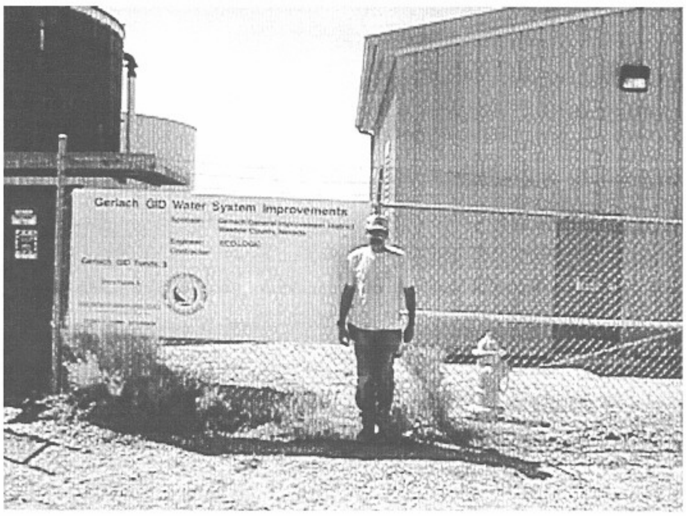
Uranium can be removed from drinking water by several treatment methods. Uranium forms ions with valences of +6, +5, +4, +3 and +2. The chief mineral of uranium, uraninite has the idealized chemical composition UO_2, uranium dioxide, from which the ion UO_2^{+2} is derived. This ion combines with bicarbonate to form negatively charged complexes. Strong base anion resins are selective for these complexes. The two most common treatment methods for small systems are anion exchange and reverse osmosis.

Anion exchange is a treatment system in which the well water flows through a tank with a resin that "exchanges" uranium for a safer compound – in most cases, chloride (Cl^-), sometimes hydroxyl (OH^-) ion.

Reverse osmosis uses a semi-permeable membrane to capture any uranium in the water. The device uses water pressure as a force against the membrane, and only water molecules are small enough to pass through, leaving the uranium and other ions behind. The membrane is continually rinsed and the reject water containing uranium is discarded. Reverse osmosis membrane technology has improved in recent years and may be much more efficient, producing only tens of gallons of waste rinse for each one hundred gallons of raw water.

Is uranium radioactive?

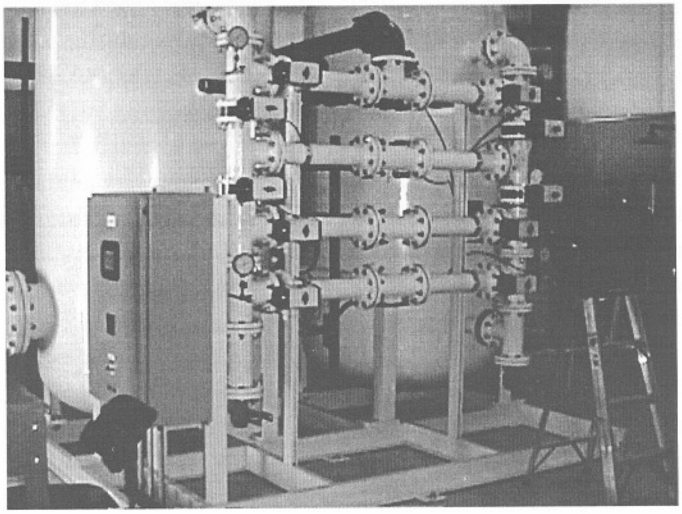
According to The Environmental Science Division of Argonne National Laboratory, all isotopes of uranium are radioactive, with most having long half-lives. Half-life is the time it takes for one half of the atoms of a particular radionuclide to disintegrate (or decay) into another nuclear



Jon Farnsworth outside the new Gerlach Treatment Facility form. Each radionuclide has a characteristic half-life. Half-lives vary from millionths of a second to billions of years. Because radioactivity is a measure of the rate at which a radionuclide decays (for example, decays per second), the longer the half-life of a radionuclide, the less radioactive it is for a given mass. A sample of natural uranium (as mined) is composed of 99.3% uranium-238, 0.7% uranium-235, and a negligible amount of uranium-234 (by weight), as well as a number of radioactive decay products. The half-life of uranium-238 is about 4.5 billion years, uranium-235 about 700 million years, and uranium-234 about 25 thousand years.

Uranium atoms decay into other atoms, or radionuclides, that are also radioactive and commonly called "decay products". Uranium and its decay products primarily emit alpha radiation, however, lower levels of both beta and gamma radiation are also emitted. The total activity level of uranium depends on the isotopic composition and processing history.

In general, uranium-235 and uranium-234 pose a greater radiological health risk than uranium-238 because they have much shorter half-lives, (decay more quickly), and are thus "more radioactive." Because all uranium isotopes are primarily alpha emitters, they are only hazardous if ingested or inhaled. However, because several of the radioactive uranium decay products are gamma emitters, workers in the vicinity of large quantities of uranium in storage or in a processing facility can also be exposed to low levels of external radiation.



Uranium treatment vessels and valve assembly